



# Advancing knowledge about great small-scale fisheries

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Small-scale fisheries (SSF) and aquaculture, both in marine and inland freshwater realms, have gained increasing recognition for their central role in developing countries (Béné 2006) and the global fisheries sector (Kurien 1998). Their contribution to fish production, employment generation, provision of essential nutrients, and sustaining culturally meaningful, gender inclusive livelihoods continue to be illuminated (Funge-Smith and Bennett 2019; FAO 2023). Their importance in the current Blue Economy discourse have also been emphasized (Cohen et al. 2019).

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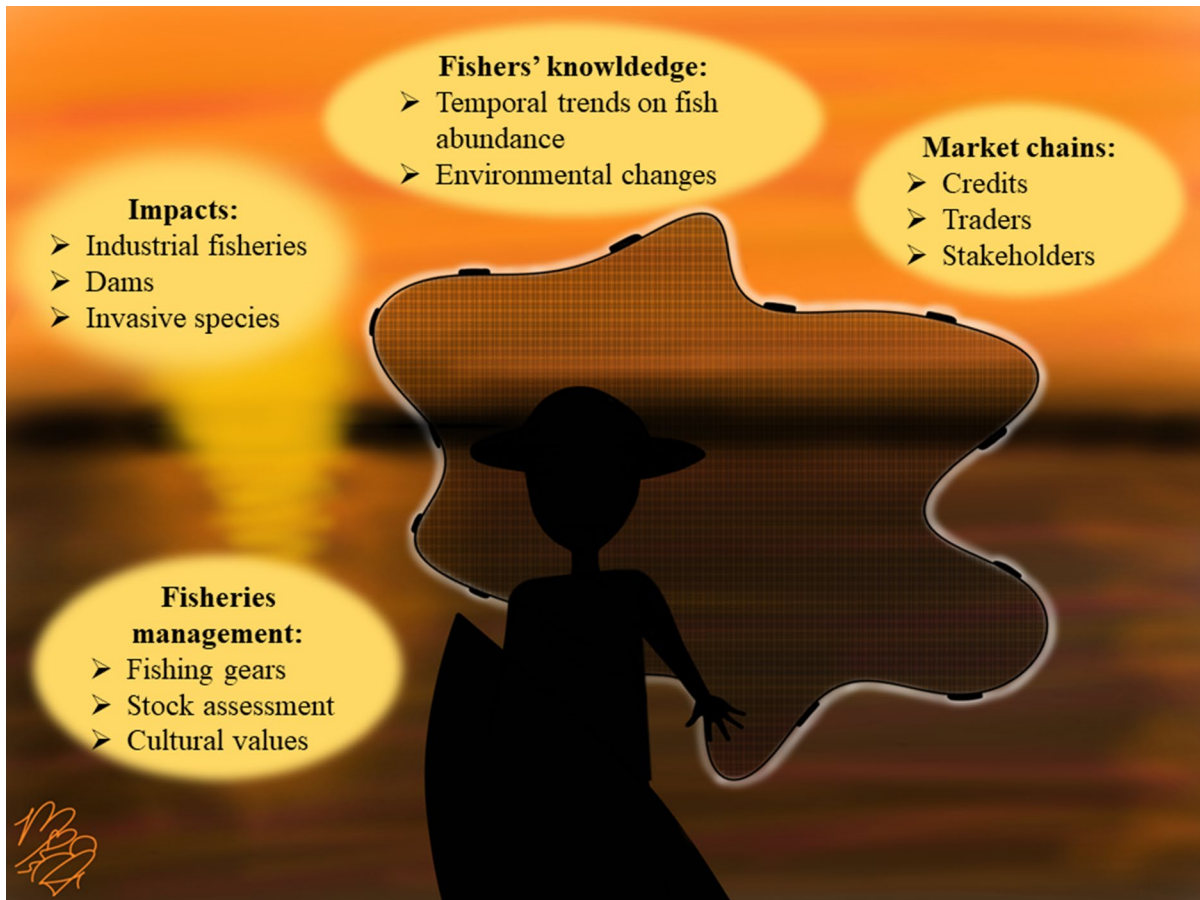
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Historically, SSF and associated aquaculture activities have often been neglected by policymakers. It was only after sustained collective action of SSF groups globally (Kurien 2014; Jentoft et al. 2018) and the endorsement of the Food and Agriculture Organization (FAO) of the United Nations (UN) Voluntary Guidelines for Securing Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines) in 2014 that formal global recognition was accorded to SSF contributions.

Within the scientific community, biological and (to a lesser extent) social sciences, have lagged in SSF research, mostly due to the lack of data, and a focus on economically important large-scale fisheries in the temperate zones. Combined with the hidden status of SSF, this lack of scientific information has further aggravated their lack of political influence in broader fishery management and development planning.

The recent Intergovernmental Panel on Biodiversity and Ecosystems Services (IPBES) report on the sustainable use of wild species acknowledges the importance of SSF but points out that their overall sustainability is unresolved due to a lack of data and intrinsic variability. However, sustainability can be achieved if fishers' participation and empowerment are promoted (IPBES 2022). This report further states that SSF face multiple threats, including competition with larger scale industrial fisheries, intensified fishing pressure driven by poverty and market demands, unfavorable and unfair market chains, habitat degradation, climatic changes and unpredictable



**Fig. 1** Some of the main topics addressed in the 20 articles that compose this special issue (drawing by Mariana Seger, based on photograph by Renato Silvano)

shocks, such as the recent pandemic (IPBES 2022). This makes it even more urgent to address the issues faced by the SSF in scientific research and policy implementation.

Fortunately, prompted by the SSF Guidelines, the value of SSF has increasingly been recognized in both science and policy making. The International Year of Artisanal Fisheries and Aquaculture (IYAF), declared by the UN in 2022, being the most significant example. This well-deserved recognition arises from SSF's direct relation to biodiversity conservation and meeting many UN Sustainable Development Goals (SDGs), including zero hunger, poverty reduction, and life below water (Lynch et al. 2020; Ainsworth et al. 2023). Securing the sustainability of SSF and improving fishers' livelihoods is also a matter of social justice (Lopes et al. 2021). Fishers involved in

SSF have a wealth of local or traditional ecological knowledge (TEK), which has provided invaluable contributions to biological science and fisheries management (Silvano et al. 2023).

It is in this context that this RFBF Special Issue (SI) on Artisanal and Small-Scale Fisheries and Aquaculture, conceived in 2022, aims to celebrate the IYAF 2022, raise awareness, improve the scientific knowledge base about SSF and aquaculture, and enhance the scope of RFBF to research on SSF. This SI contains 20 articles addressing multiple topics related to SSF (Fig. 1) in 14 developing and developed countries, ranging from tropical to temperate regions. Some articles include multiple countries in a broader perspective, such as a review on the status and management of SSF in the Persian Gulf (Ben-Hasan and Daliri 2022), or the point of view article

stating the relevance of SSF to provide nutrients to impoverished people and children in the Global South and the need to orient fisheries governance to address the concerns of these vulnerable people relying on fish for food security (Allegretti and Hicks 2022).

Most of the studies in this SI followed an interdisciplinary approach, merging concepts and methods from natural and social sciences. Although aquaculture was included in the scope of this SI, most of the manuscripts submitted and accepted for publication address capture fisheries. Therefore, another SI devoted to small-scale aquaculture may be needed in the near future.

An important recurrent theme in this SI is the relevance and potential contributions of fishers' TEK to improve the science and management of SSF. Fishers' knowledge provides a complementary and sometimes unique source of data on temporal trends in the abundance of fish stocks in freshwater fisheries in Argentina (Rabuffetti et al. 2022) and Congo (Castello et al. 2023). Fishers' knowledge also indicates patterns of fish declines over time, environmental changes, and main categories of fishing practices in the Mauritius Island, a small island developing state in the Indian Ocean (Appadoo et al. 2022). Other studies show the importance of fishers' TEK in understanding fish behavior, the marine environment, and the overall dynamics of SSF in the Caspian Sea in Iran (Rasekhi et al. 2022), and climate associated aspects of a centuries-old traditional fisheries in Puruvesi Lake in Finland (Mustonen et al. 2022). Taken together, these studies reinforce the immense value of fishers TEK and the need for it to be properly recognized and for local fishers empowered and included in fisheries management.

Another relevant topic is market and value chains and their multiple effects on fishers' income, behavior, and fisheries management. One study investigates the perceptions of sustainability held by fishers and other stakeholders in the value chain of octopus fisheries in Spain, proposing that certification and cooperatives may enhance sustainability of these SSF (Ainsworth et al. 2023). Another study provides a detailed analysis of the credit market to a coastal fishery in India (Suresh 2023), showing that formal financial credit options have not been available to fishers, who must rely on informal credit with high interest rates. This may be due to the failure of formal-credit systems to deal with the high risk inherent

to these fisheries, leaving fishers bearing the risk and financiers taking the profits. The informality of trade is a hallmark of SSF worldwide. A study on informal trade of dried and highly nutritious pelagic fish species in Tanzania reveals that cross-border informal trade among countries neighboring Lake Victoria may reach up to seven times the value of official reported trade (Ibengwe et al. 2023).

Unpredictable and variable income is also typical of SSF. A study addressing the factors that influence fishers' income over time in coastal Brazilian fisheries indicates that changing fishing techniques and boat size could influence income, but some fishers may be trapped in poverty (Damasio et al. 2022). Other research shows how relationships between fishers and traders can influence potentially unsustainable fishing practices that do not comply with current fishing regulations in reef fisheries operating in biodiversity-rich marine ecosystems in Indonesia (Elsler et al. 2023). Another study deals with market changes on the trade of dried marine fish in India driven by the expansion of intensive aquaculture, which redirects dried fish from consumption by poor people to inputs for fish meal and fish oil with negative consequences for nutrition and women's employment (Surathkal et al. 2023). These studies show the importance of considering the market component of SSF, as failures in credit, income provision, or changes in market chain orientation can push fishers into poverty, deprive poorer consumers of fish, and lead to unsustainable fisheries.

Some studies focus on the many impacts or drivers that can affect SSF, including environmental change, conflicts with large-scale fisheries or aquaculture, pollution, and invasive species. One such study reviews the main drivers—dams, reservoirs, protected areas, and overfishing—that lead to conflicts and undermine freshwater SSF in India (Kelkar 2023). Another study investigates the interactions among marine pollution, increased occurrence of invasive plant species and predatory dolphins, and their effects on fishers on the Mediterranean coast of Spain. These SSF that employ trammel nets have been negatively affected by both dolphin predation and net obstruction by plants, causing considerable loss of catchability, capital, and income for the fishers (Báez et al. 2023).

Conflicts between large-scale industrial fisheries and SSF are widespread, especially in coastal developing countries. These conflicts are the focus of a

study addressing marine fisheries in Ghana where qualitative data from interviews with fishers reveal that uncontrolled expansion of industrial fisheries can lead to conflicts over fishing resources, damage to fishing gears, risk to fishers' lives and reduced income among small-scale fishers. This research claims that Blue Economy policies have further promoted industrial fishing at the expense of marginalized SSF around the world (Ayilu et al. 2023).

Other topics addressed in this SI include fisheries management, governance, fishing strategies, stock assessment, and the cultural identity of small-scale fishers. Two studies aim to improve understanding on methods for fish stock assessment and fishers' behavior in distinct SSF. One research applies three length-based models to estimate the sustainability of 15 stocks of marine fishes in Azores multispecies SSF, providing indicators for these SSF that usually lack detailed stock data. This research could reliably indicate sustainable and overfished stocks, contributing to fisheries management measures aimed to reduce fishing effort or adjusting the minimum length of capture (Medeiros-Leal et al. 2023). Another study investigates the potential benefits of gillnets to fishers compared to other fishing gears in freshwater SSF in the Amazon basin in Brazil, considering that use of gillnets is ubiquitous in these fisheries. This study concludes that gillnets may perform better than other gears, but combinations of gillnets and other gears may provide better outcomes to fishers (Hallwass et al. 2023).

One study investigates fishers' perceptions on management and governance strategies, as well as how environmental changes and invasive species have affected the abundance of harvested anadromous fishes along two rivers crossing two countries (Portugal and Spain) in the Iberian Peninsula. The observed fishers' perceptions in the two studied rivers could help to inform the development of broader management strategies for long distance migratory fishes in transboundary fishing (Stratoudakis et al. 2022). Finally, one study analyzes the cultural identity associated with the commonly used term 'community' in the context of SSF, and derives three configurations—livelihood, way of life and job—based on four case studies from Mexico (Delgado-Ramírez et al. 2022).

The variability and diversity of topics addressed and studied in this SI reflects the complex variability

of SSF. They also address themes of broader relevance to SSF elsewhere, including stock assessments based on fishers' knowledge; influence of market chains on fishers' behavior and fisheries sustainability; conflicts with industrial fisheries; underlying motivations influencing the use of fishing gear; and fishers' knowledge about environmental changes among others (Fig. 1).

The twenty case studies in this SI contribute to strengthening the knowledge base about SSF inspiring further research. Although considered small-scale due to fishing intensity, range of operation and technology used, these fisheries sustain the livelihoods of millions of people and involve rich cultural traditions and in-depth fishers' knowledge. SSF deserves greater attention and achieving sustainable SSF is an imperative challenge that requires continued scientific support. This SI is one more paddle stroke in this direction.

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